EMBRYOLOGY.[1]

Cytotropism.—Professor Wilhelm Roux, the leader of the new school of Embryology that seeks to investigate developmental phenomena by the aid of experimental methods, has published in his new periodical some very interesting results obtained on his often used object, the frog's egg.[2]

The eggs were teased apart in salt solution, white of egg, or in a mixture of both, and observed under precautions necessary to prevent currents and jars in the liquids. When so treated the isolated cells, for eggs are used in later cleavage and bastula stages when each is divided up into many cells, lie in the liquid at varying distances from one another and quite separate.

It is now found that movements may take place that results in the union of some of these isolated cells. These movements are a gliding or creeping, since the cells lie on the glass slide and not suspended in the liquid. In many cases, especially when salt solution is used, the cells throw out pseudopodia that may be all clear protoplasm or else contain a granular axial mass. These may anastomose with pseudopodia of other cells. The pseudopodia, however, are not concerned in the motions which are actual translations of entire cells without any visible means or cause.

The movements do not take place between all cells and seem to vary in power in the same cells. In the frog *Rana fusca* eggs from the latter part of the breeding season show no movements. In other species namely *R. esculenta*, *Bombinator igneus* and in the fish *Telestes agassizii* no movement could be detected.

In detail these movements are found to be of limited extent but yet capable of resolution into considerable complexity. Only cells having diameters of from 20 to 60 microns show the phenomena and only when not more than their own diameter apart. We are thus dealing with migration of small amounts of matter along very short distances. The cells move along the shortest distance between them but not without vibrations from side to side. The latter part of their course when about to unite is generally more rapidly accomplished than the first. A few minutes to an hour or two may be taken in moving these short distances, e. g. 40 microns.

[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts, reviews and preliminary notes may be sent.

[2] Archiv f. Entwicklungsmechanik, Vol. I. Oct. and Dec., 1894.

Larger cells may move toward smaller and vice versa, or both toward one another.

When three cells are concerned one may move toward another directly or may at first move as if in the resultant line of forces proceeding from each of the other two.

Mass does not seem concerned in these movements for several cells in a group (not separated from one another in the teasing) do not act as a whole, but one of them may attract or else be attracted by some isolated cell lying near.

Many cells may eventually come together and form a firm aggregate out of a scattered collection of isolated cells.

It appears that these attractive movements take place between cells of separate eggs as well as between the cells of the same egg. Moreover, it was found that the cells of later stages, of the gastrula and young tadpole stage, may move. Thus cells that were forming the nervous system may, when isolated, round themselves off, become amœbird and even, in some cases, draw together till they touch.

Besides the change of position hitherto mentioned there is a marked change of form. In general two active cells protrude on the side towards the other cell so that they may be said to flow out towards one another to a certain extent. There is also considerable change in outline, elongation and contraction of the cell while moving or while serving as the centre of attraction or of movement for another cell.

A cell may even divide while also moving towards another.

The explanation of these complex movements of isolated cells in the frog embryo remains for the future, but provisionally the author refers them to the general class of movements brought about as the result of chemical action. That they are not simply physical, but results of life in the cells, the author seems to prove by careful examination of the sources of error and by controlling the conditions of experimentation.

He would class these movements with those of sperm cells towards ova and of conjugating infusoria towards one another as cases of CYTOTROPISM; he pictures to himself a chemical or chemotactic source for the movements by supposing that the cells secrete chemical substances that effect other cells so as to direct their movement as well as to incite it. This movement under the stimulus of adjoining chemicals would differ from that observed by Pfeffer, in that here the cell does not move towards the region of greatest concentration of substance, but, in that it moves to another cell and thus into the field filled by substances from two cells, towards the region where the substance is least dilute.

Since this cytrotropic state seems to vary in any cell it may play a varying and not unimportant part in the phenomena of ontogeny.

By its instrumentality, cells may, at one time unite, at another, remain separate. Migrations of cells towards oxygen on the surface of the egg, etc., would also be exhibitions of these same cytrotropic powers.